

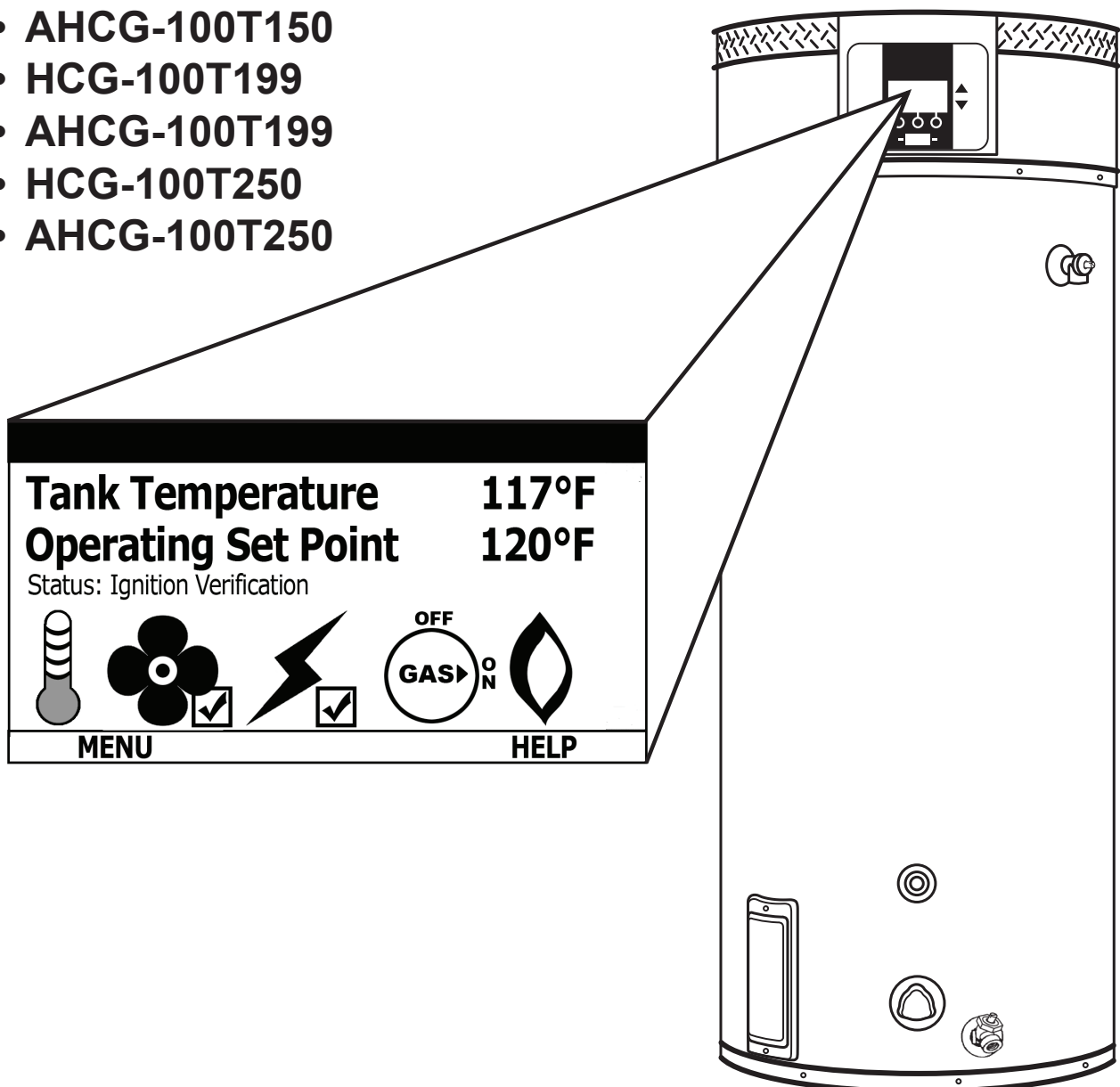


SERVICE HANDBOOK

HIGH EFFICIENCY COMMERCIAL GAS SERIES

FOR MODELS:

- HCG-60T120
- AHCG-60T120
- HCG-100T150
- AHCG-100T150
- HCG-100T199
- AHCG-100T199
- HCG-100T250
- AHCG-100T250



High-Efficiency Commercial Gas Series - Service Manual

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INTRODUCTION

The service manual is designed to aid in servicing and troubleshooting High-Efficiency Commercial Gas Series water heaters in the field. Duplication or reproduction of this manual is forbidden without the express written authorization from the manufacturer.

The following text and illustrations will provide you with a step by step procedure to verify proper installation, operation, and troubleshooting procedures. Additional quick reference data is included to assist you in servicing these products.

The information contained in this manual is designed to answer commonly faced situations encountered in the operation of this product line and is not meant to be all inclusive. If you are experiencing a problem not covered in this manual, please contact the manufacturer via information listed in the instruction manual that came with the water heater and/or the labeling on the water heater.

This manual does not replace or supersede the Instruction Manual that came with the water heater. Always refer to the Instruction Manual that came with the water heater for complete installation instructions.

QUALIFICATIONS

ANSI Z223.1 Sec 3.3.83

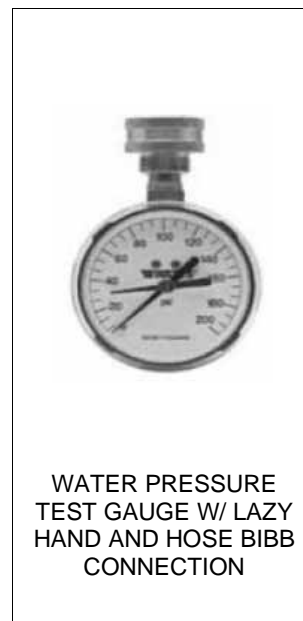
"Qualified Agency"

"Any individual, firm, corporation or company that either in person or through a representative is engaged in and is responsible for (a) the installation, testing or replacement of gas piping or (b) the connection, installation, testing, repair or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction."

Service of this water heater requires ability equivalent to that of a Qualified Service Agent (licensed tradesman) in the field involved. Installation skills such as plumbing, air supply, venting, gas supply, electrical supply are required in addition to electrical testing skills. Some products may require combustion testing equipment and certification. If you do not possess these skills or do not have the proper tools you should not attempt to service this water heater.

TOOLS REQUIRED

- ELECTRICAL MULTIMETER CAPABLE OF MEASURING CONTINUITY/ OHMS, AC & DC VOLTS, AMPERES, MICROAMPERES, MILLIVOLTS, and FREQUENCY(Hz)
 - UeI Model DL289 or equivalent
- DIGITAL MANOMETER ± 60 " W. C. in .01" increments
 - Note: A digital manometer is required for testing pressure switches and can replace a gas pressure gauge, draft gauge or slack tube manometer for checking gas pressure.
 - UeI model EM200, TPI model 620 or equivalent
- WATER PRESSURE GAUGE w/ LAZY HAND AND HOSE BIBB CONNECTION
- THERMOMETER
- 1-1/16 INCH SOCKET WITH EXTENSION FOR ANODE REPLACEMENT
- SET OF NUMBERED DRILL BITS



GENERAL INFORMATION

INSTALLATION REQUIREMENTS FOR THE COMMONWEALTH OF MASSACHUSETTS

For all side wall terminated, horizontally vented power vent, direct vent, and power direct vent gas fueled water heaters installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

INSTALLATION OF CARBON MONOXIDE DETECTORS

At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the sidewall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors. In the event that the side wall horizontally vented gas fueled

equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements provided that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed

APPROVED CARBON MONOXIDE DETECTORS

Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and CSA certified.

SIGNAGE

A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2") inch in size,

“GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS.”

GAS PRESSURE REQUIREMENTS

MODELS	Natural 120-150	Propane 120-150	Natural 199-250	Propane 199-250
Maximum Gas Supply Pressure	10.5" WC (2.59kPa)	14.0"WC (3.45kPa)	10.5"WC (2.59kPa)	14.0"WC (3.45kPa)
Nominal Gas Supply Pressure	7.0"WC (1.74kPa)	11.0"WC (2.74kPa)	7.0"WC (1.74kPa)	11.0"WC (2.74kPa)
Minimum Gas Supply Pressure (Low Gas Press. Switch Setting)	4.8"WC (1.20kPa)	8.5"WC (2.12kPa)	4.8"WC (1.20kPa)	8.5"WC (2.12kPa)
Manifold Pressure	4.0"WC (0.98kPa)	10.0"WC (2.49 kPa)	0"WC (0 kPa)	0"WC (0 kPa)

GAS PRESSURES – 120 and 150 KBtu/hr MODELS

ADJUSTMENT PROCEDURE:

GAS PRESSURE 120 AND 150 MODELS

Verify supply gas pressure is within the requirements given in the Instruction Manual that came with the water heater and shown in the table on page 4 prior to start up.

A supply gas pressure regulator (service regulator) must be installed on the gas supply line within 10' (305 cm) of the unit.

1. Check gas line pressure with a manometer.
2. Check manifold pressure with a manometer connected to the manifold pressure tap on the gas control valve.
If full rate adjustment is required, remove cover screw from top of the gas control valve. Using a small screwdriver, turn adjusting screw clockwise to increase or counterclockwise to decrease gas pressure to obtain manifold pressures given in the table on page 4.
3. Cycle the burner on and off several times to check and check operation.

HIGH ALTITUDE INSTALLATIONS 120 AND 150 MODELS

For appliance installation locations with elevations above **6,500** feet (1982 meters) consult the "High Altitude Installation" section of the Instruction Manual that came with the water heater.

CHECKING THE FIRING RATE

- a. Attach a manometer to the manifold pressure tap on the gas valve – refer to the table on page 4 for correct pressure.
- b. Use this formula to "**clock**" the meter. Be sure other gas consuming appliances are not operating during this interval.

$$\text{Btuh} = 3600 \times \text{H} / \text{T}$$

T = Time in seconds to burn 1 cubic foot of gas.
(With a stopwatch read the gas meter and measure the amount of time required for the heater to consume 1 cubic foot of gas.)

H = Heating value of gas (in Btu's per cubic foot of gas).

Btuh = Actual heater input rate, in Btuh.

EXAMPLE: (150 KBtu/hr model)

T = 25.25 seconds

H = 1050 Btu/ft.3

BTUH = ?

Compare result to the de-rated input required for the elevation at the installation location.

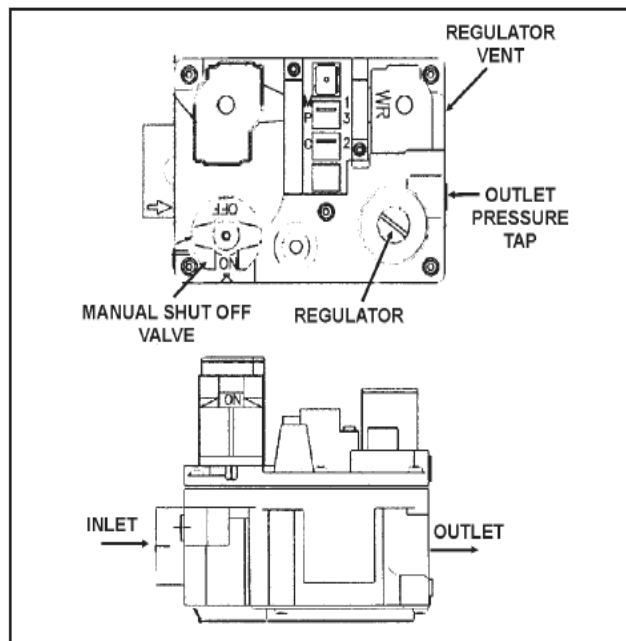
Should it be necessary to adjust the gas pressure to the burner, to obtain the full input rate, the steps below should be followed:

- c. Remove the pressure regulator cover screw and adjust the pressure by turning the adjusting screw with a small screwdriver. Do not exceed 4.0" (1 kPa) natural gas models and 10.0" w.c. (2.5kPa) on the propane models. Clockwise to increase gas pressure and input rate. Counterclockwise to decrease gas pressure and input rate.
- d. "Clock" the meter as in step (b) above.
- e. Repeat steps (c) and (d) until the specified input rate is achieved.
- f. Turn the manual gas valve to "OFF". Replace the pressure regulator cover screw. Remove the pressure gauge or manometer from the manifold pressure tap. Replace the set screw in the manifold pressure tap. If the gas pressure regulator cannot be adjusted to give the full input rating with sufficient gas pressure at the valve, check to ensure the unit is equipped with the correct orifice.

GAS VALVE 120 KBtu/hr MODEL

The gas control valve on the 120 KBtu/hr model has a built in adjustable pressure regulator. The adjustment screw is accessed by removing the cap screw market regulator in the illustration.

Inlet gas pressure may be read at the inlet pressure tap only if the manual shut off valve (gas cock) is in the "ON" position. Leaving the knob in the "OFF" position will not allow the burner to fire and will generate a fault code on the UIM (Universal Interface Module).



GAS VALVE 150 KBtu/hr MODEL

The gas control valve on the 150 KBtu/hr model is has a built in pressure regulator. The regulator may be adjusted by removing the cap screw marked "regulator" in the illustration.

Inlet gas pressure may be read at the inlet pressure tap only if the manual switch is set the "ON" position.



GAS PRESSURES 199 and 250 KBtu/hr MODELS

**ADJUSTMENT PROCEDURE:
GAS PRESSURE
199 AND 250 MODELS**

IMPORTANT NOTE

THE 199 AND 250 MODELS INCORPORATE A NEW GAS CONTROL, WHICH OPERATES AT A MANIFOLD PRESSURE OF 0"W.C. (0 kPa) FOR BOTH NATURAL AND PROPANE GAS. SEE THE GAS PRESSURE CHART ON PAGE 4. THESE MODELS ARE FACTORY SET, NO MANIFOLD GAS PRESSURE ADJUSTMENTS ARE NECESSARY PRIOR TO STARTUP.

Verify supply gas pressure is within the requirements given in the Instruction Manual that came with the water heater and shown in the table on page 4 prior to start up. The inlet gas pressure must not exceed the maximum values.

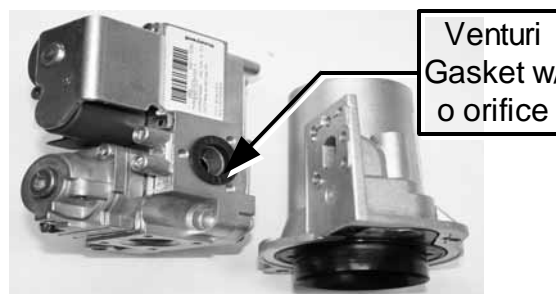
A supply gas pressure regulator (service regulator) must be installed on the gas supply line within 10' (305 cm) of the unit.

HIGH ALTITUDE INSTALLATION

The 199 and 250 models are suitable for installation up to 10,100 feet above sea level with no adjustments.

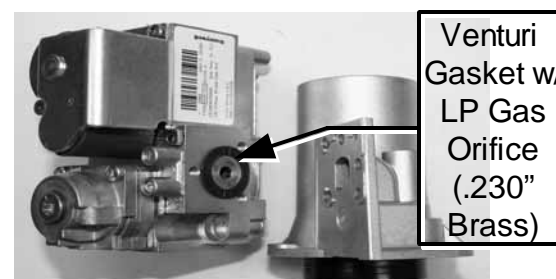
GAS ORIFICE

The 199 and 250 models do not have a natural gas orifice. A .230" orifice is used on LP gas models.



Gas Control Without Orifice

Natural Gas

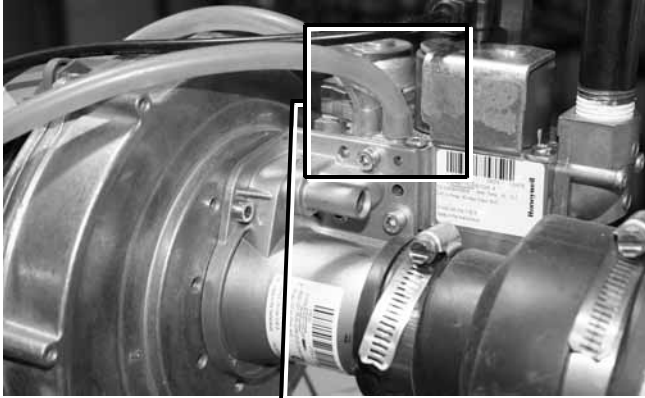


Gas Control with .230" LP Orifice

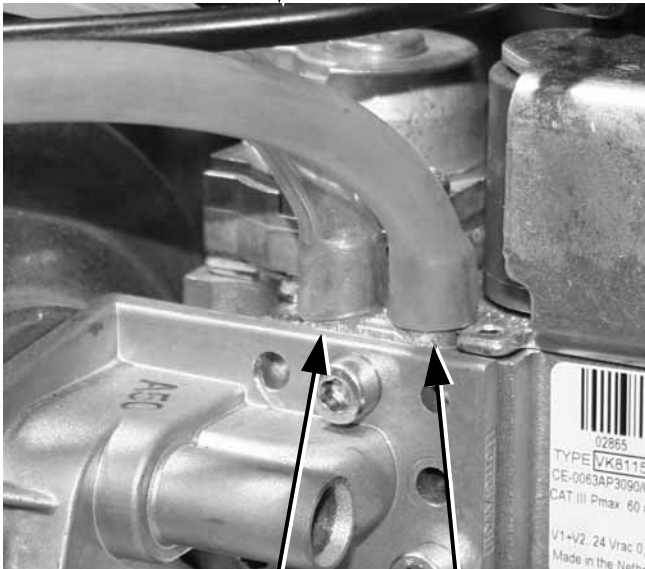
GAS VALVE 199 and 250 KBtu/hr MODELS

Pressure readings may be taken on the gas valve by connecting a manometer to the pressure ports on the valve. The manifold pressure on this valve is 0" w.c. (0kPa) when the water heater is running. Refer to the gas pressure chart on page 4.

Note: Manometer tubing shown is not supplied with the water heater.



WARNING: Do not attempt adjustments on this gas valve. Contact the "help line" listed on the water heater for assistance.



Manifold
gas
Pressure
0" WC
(0kPa)

Supply
gas
pressure

High-Efficiency Commercial Gas Series - Service Manual

VENTING TABLES

Maximum equivalent feet of intake air and vent pipe using 3" PVC is 50 feet (15.2m). Equivalent feet must include any 90° elbows (two 45° elbows equal one 90° elbow). Three inch diameter 90° elbows are equivalent to 5' (1.5m) of pipe.

Maximum equivalent feet of intake and vent pipe using 4" PVC is 120 feet (36.6m). Equivalent feet must include any 90° elbows (two 45° elbows equal one 90° elbow). Four inch diameter 90° elbows are equivalent to 5' (1.5m) of pipe.

Vent/Intake Air Pipe Equivalent Feet (Meters)

Number of 90° Elbows	3" Minimum Pipe (Ft./M.)	3" Maximum Pipe (Ft./M.)	4" Maximum Pipe (Ft./M.)
ONE (1)	7/2.1	45/13.7	115/35
TWO (2)	7/2.1	40/12.2	110/33.5
THREE (3)	7/2.1	35/10.7	105/32
FOUR (4)	7/2.1	30/9.1	100/30.5
FIVE (5)	7/2.1	---	95/29
SIX (6)	7/2.1	---	90/27.4

VENTING - ALL MODELS – SINGLE PIPE POWER VENT – USING ROOM AIR

⚠ WARNING
VENT HOOD(S) MAY BE EXTREMELY HOT DURING OPERATION

U.S. POWER VENT

MINIMUM 18 INCHES (46 CM)

1 FT. (30 CM) ABOVE GRADE OR EXPECTED SNOW FALL

MINIMUM 3 FT. (91 CM) WITHIN A HEIGHT OF 15 FT. (4.6 M) ABOVE METER/REGULATOR ASSEMBLY

MINIMUM 3 FT. (91 CM) CLEARANCE TO SERVICE REGULATOR VENT OUTLET

MINIMUM 1 FT. (30 CM) UNDER VERANDA, PORCH, DECK OR BALCONY (SEE FOOTNOTE 1)

MINIMUM 3 FT. (91 CM) ABOVE A MECHANICAL AIR SUPPLY INLET WITHIN 10 FT. (3 M) HORIZONTALLY

MINIMUM 4 FT. (1.2 M) BELOW OR SIDE OF 1 FT. (30 CM) ABOVE NON MECHANICAL AIR SUPPLY INLET INTO BUILDING OR COMBUSTION AIR INLET TO ANOTHER APPLIANCE.

MINIMUM 4 FT. (1.2 M) FROM SIDE OF WINDOW THAT MAY BE OPEN

MINIMUM 4 FT. (1.2 M) BELOW A WINDOW THAT MAY BE OPEN

MINIMUM 1 FT. (30 CM) ABOVE WINDOW OR DOOR THAT MAY BE OPEN

MINIMUM 2 FT. (61 CM) FROM OUTSIDE CORNER

MINIMUM 4 FT. (1.2 M) TO SIDE OR 1 FT. (30 CM) ABOVE DOOR

MINIMUM 4 FT. (1.2 M) FROM SIDE OF WINDOW THAT MAY BE OPEN

1 FT. (30 CM) FROM SOFFIT

MINIMUM 7 FT. (2.3 M) ABOVE PUBLIC SIDEWALK OR PAVED DRIVEWAY (SEE FOOT NOTE 2)

MINIMUM 1 FT. (30 CM) FROM SIDES OF PERMANENTLY CLOSED WINDOW

INSIDE CORNER DETAIL

FIXED CLOSED OPERABLE

FIXED CLOSED

OPERABLE

VENT TERMINAL (V) **AIR SUPPLY INLET** (X) **AREA WHERE TERMINAL IS NOT PERMITTED** (shaded)

1. PERMITTED ONLY IF VERANDA, PORCH, DECK OR BALCONY IS FULLY OPENED ON A MINIMUM OF TWO SIDES BENEATH THE FLOOR.
2. A VENT SHALL NOT TERMINATE ABOVE A SIDEWALK OR PAVED DRIVEWAY THAT IS LOCATED BETWEEN TWO SINGLE FAMILY DWELLINGS AND SERVES BOTH DWELLINGS.

***MINIMUM 1 FT. (30 CM) FOR APPLIANCES WITH 10,000 BTUH (3 Kw) TO 100,000 BTUH (30 Kw) INPUT AND 36 IN. (90 CM) FOR AN APPLIANCE GREATER THAN 100,000 BTUH (30 Kw) TO A WINDOW OR DOOR THAT MAY BE OPENED**

CANADIAN POWER VENT

⚠ WARNING
VENT HOOD(S) MAY BE EXTREMELY HOT DURING OPERATION

MINIMUM 18 INCHES (46 CM)

1 FT. (30 CM) ABOVE GRADE OR EXPECTED SNOW FALL

MINIMUM 3 FT. (91 CM) WITHIN A HEIGHT OF 15 FT. (4.6 M) ABOVE METER/REGULATOR ASSEMBLY

MINIMUM 3 FT. (91 CM) CLEARANCE TO SERVICE REGULATOR VENT OUTLET

MINIMUM 1 FT. (30 CM) UNDER VERANDA, PORCH, DECK OR BALCONY (SEE FOOTNOTE 1)

MINIMUM 6 FT. (1.83 M) TO A MECHANICAL AIR SUPPLY INLET

MINIMUM 1 FT. (30 CM) FOR APPLIANCES WITH 10,000 BTUH (3 Kw) TO 100,000 BTUH (30 Kw) AND 36 IN. (90 CM) FOR APPLIANCES GREATER THAN 100,000 BTUH (30 Kw) TO A NON MECHANICAL AIR SUPPLY INLET INTO BUILDING OR COMBUSTION AIR INLET TO ANOTHER APPLIANCE

MINIMUM 1 FT. (30 CM) FROM SIDES, ABOVE OR BELOW A PERMANENTLY CLOSED WINDOW OR DOOR

MINIMUM 2 FT. (61 CM) FROM OUTSIDE CORNER

MINIMUM 7 FT. (2.3 M) ABOVE PUBLIC SIDEWALK OR PAVED DRIVEWAY (SEE FOOT NOTE 2)

1 FT. (30 CM) FROM SOFFIT

INSIDE CORNER DETAIL

FIXED CLOSED OPERABLE

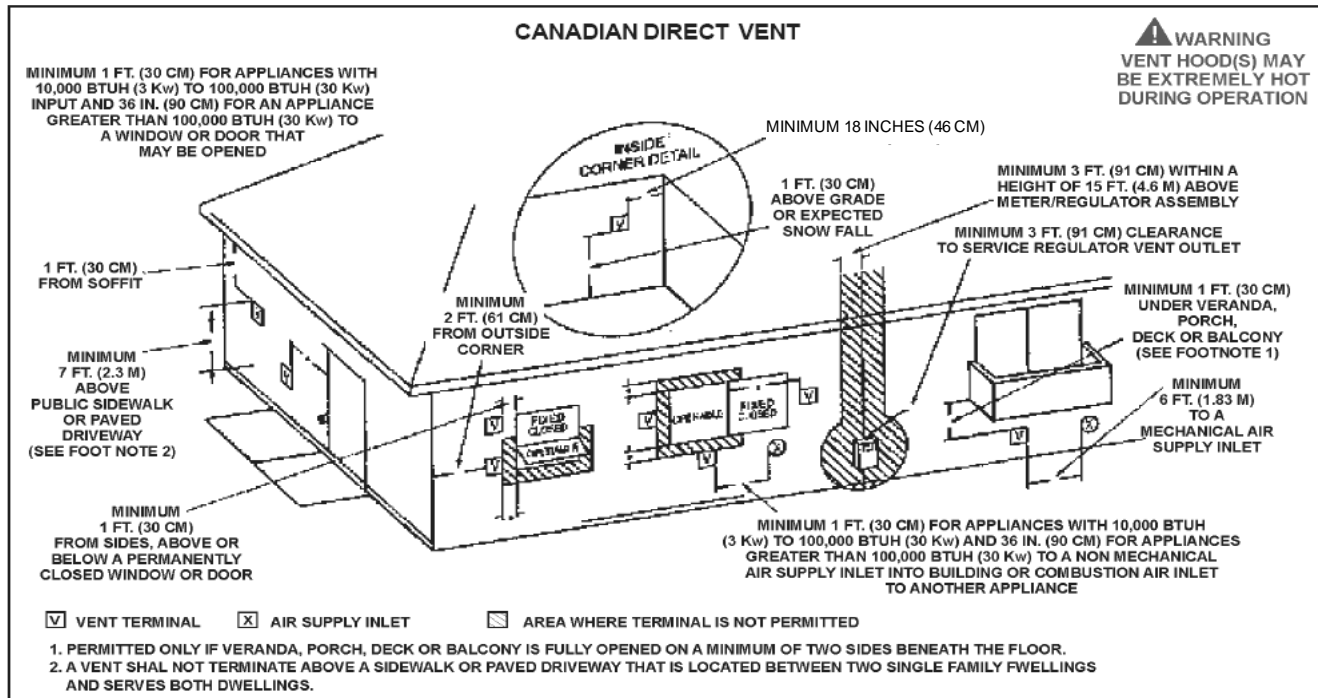
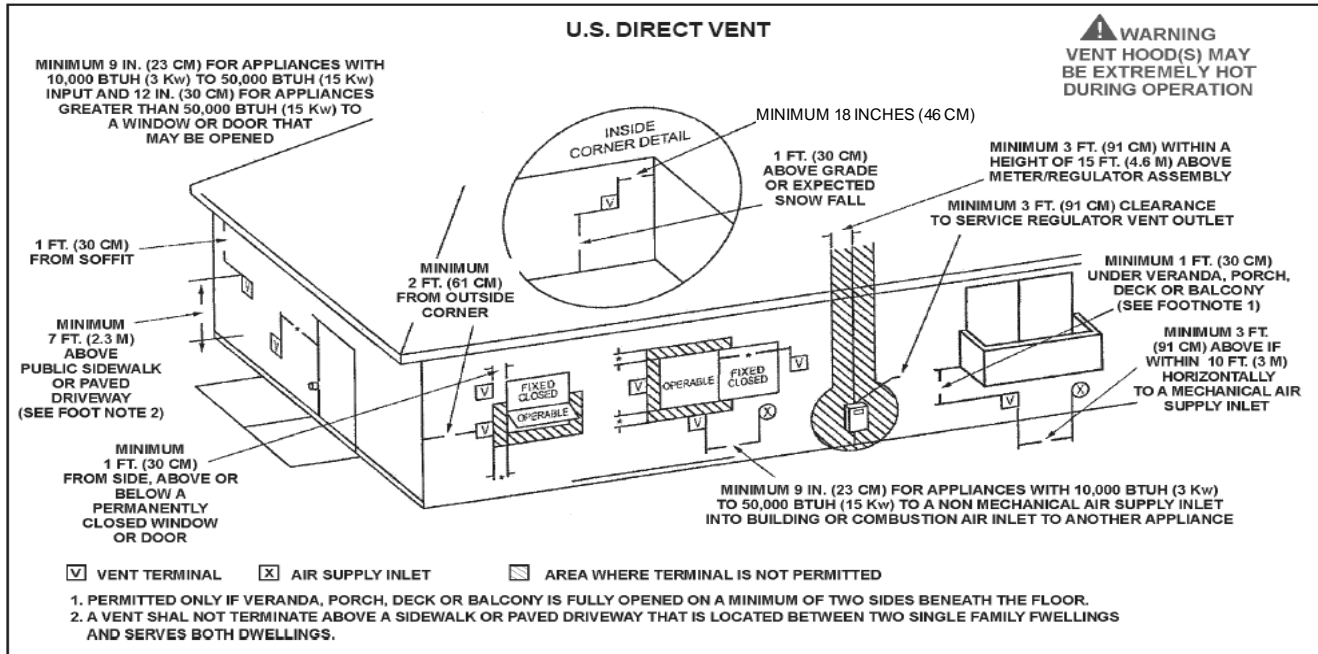
FIXED CLOSED

OPERABLE

VENT TERMINAL (V) **AIR SUPPLY INLET** (X) **AREA WHERE TERMINAL IS NOT PERMITTED** (shaded)

1. PERMITTED ONLY IF VERANDA, PORCH, DECK OR BALCONY IS FULLY OPENED ON A MINIMUM OF TWO SIDES BENEATH THE FLOOR.
2. A VENT SHALL NOT TERMINATE ABOVE A SIDEWALK OR PAVED DRIVEWAY THAT IS LOCATED BETWEEN TWO SINGLE FAMILY DWELLINGS AND SERVES BOTH DWELLINGS.

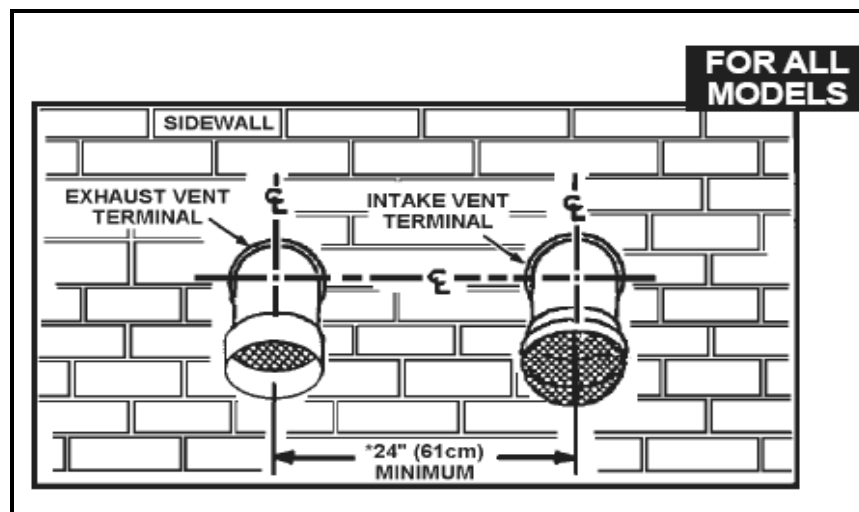
VENTING – ALL MODELS – TWO PIPE DIRECT VENT – USING OUTSIDE AIR



VENT / INTAKE AIR TERMINATIONS

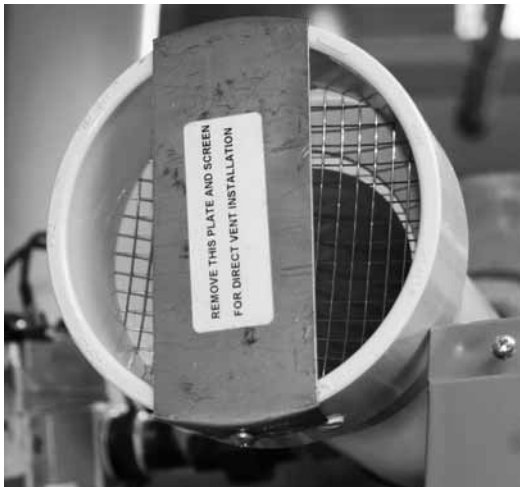
WHEN LOCATING THE VENT AND INTAKE AIR TERMINATIONS ON A SIDEWALL, THE FOLLOWING SPECIFICATIONS PERTAINING TO LOCATION AND CLEARANCES MUST BE FOLLOWED.

1. The intake vent terminal and the exhaust vent terminal must terminate on the same exterior wall and must be located at a minimum of 24" (61cm) from the vertical centerline of the exhaust vent terminal (see Figure 9). In colder climates increasing the 24" (61cm) minimum will reduce possibility of frost over from side winds blowing exhaust vapors to the air intake of the direct vent.
2. The horizontal centerline of the intake vent terminal **may not** be located lower than the horizontal centerline of the exhaust vent terminal.

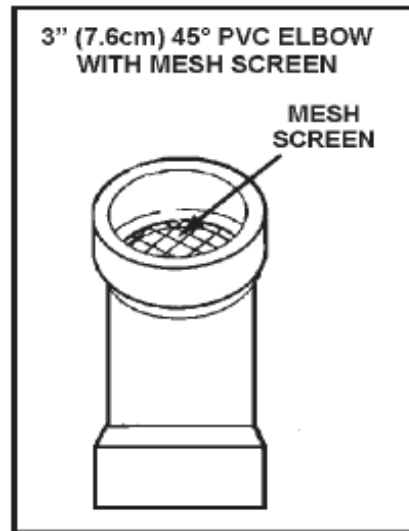


DIRECT VENT INSTALLATIONS

The intake air connection on the water heater contains a mesh screen to prevent large particles from entering the blower. **WHEN THE WATER HEATER IS INSTALLED DIRECT VENT (TWO PIPES), THE BALANCE PLATE AND MESH SCREEN MUST BE REMOVED BEFORE GLUING PIPE TO THE CONNECTOR.**



Remove the balance plate and mesh screen before gluing intake air pipe to the fitting.



45° PVC Elbow
Vent/Intake Air Terminations
120-250

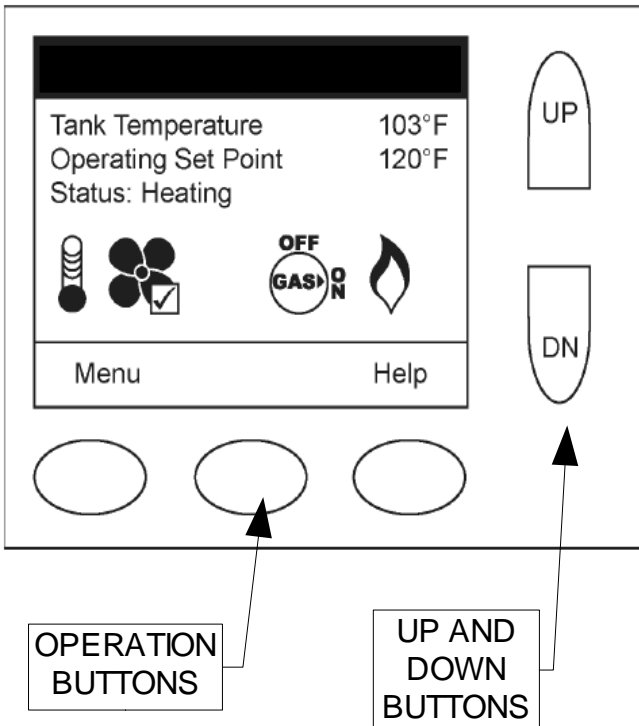
Terminations and mesh screens are provided. Both terminations will be used in direct vent installations. The screens are provided to prevent vermin, birds, or large debris from entering the intake air and exhaust vent piping and should never be removed.

CONTROL OVERVIEW

Interaction with the control system is done through the **User Interface Module (UIM)**. The default screen is referred to as the “**desktop**” or “**desktop screen**”. Up and down buttons and three operation buttons allow navigation of the control system menus and changing of user settings. The current function of the three operation buttons is determined by the text displayed on the UIM immediately above each button.

During normal operation the UIM will display the desktop screen (if there are no active faults or warnings).

- An example of this screen is shown below.
- The first temperature on this screen is the temperature of the water inside the tank.
- The second temperature on this screen is the *Operating Set Point*.
- The *Operating Set Point* is the temperature at which the water heater will maintain the water inside the tank.
- The third line on the screen is a text description of the *Operational State* of the water heater. The operating state of the water heater is also indicated graphically by status icons.



The table of status icons describes graphically operational details of the water heater. Below is a legend of all the status icons:

Status Icon	Description
	The temperature of the water in the tank has fallen and the water heater will now initialize a new heating cycle.
	The temperature of the water in the tank has reached the <i>Operating Set Point</i> .
	The control is unable to initiate any further heating cycles. This is usually caused by a fault condition detected by the control, but can also occur when an external system (like an energy management system) has asked the water heater to discontinue any further heat cycles.
	The blower is being energized.
	The blower pressure switch has been made.
	The igniter has been energized.
	The igniter has been energized and sufficient current for ignition has been detected.
	The control has requested that the gas valve be turned on.
	The control has sensed flame in the burner.
	The control has detected a fault condition. A fault condition will cause the water heater to discontinue operation.
	The control has detected a warning condition. These conditions will not cause the water heater to discontinue further heating cycles, but does merit attention.

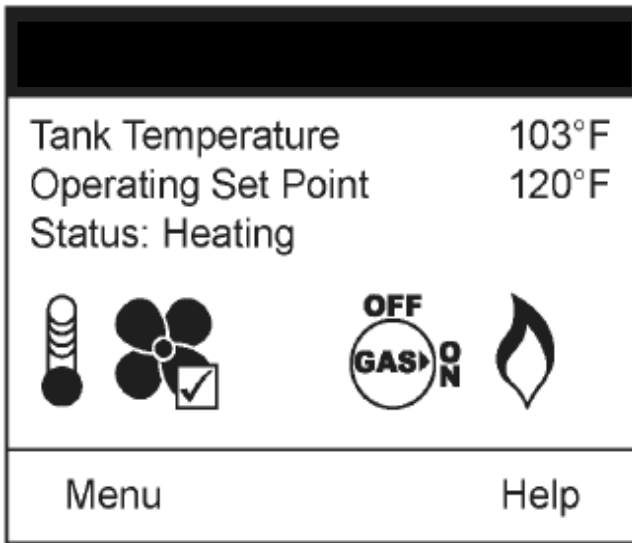
ADJUSTING TANK TEMPERATURE – OPERATING SET POINT - DIFFERENTIAL

The *Operating Set Point* of this water heater determines the regulated temperature for the water in the tank. This parameter is adjusted in the desktop Temperature menu. Items in this menu allow you to monitor different temperature readings in the tank along with adjusting the *Operating Set Point* and *Differential*.

ACTION:

From the desktop screen, press **Menu**.

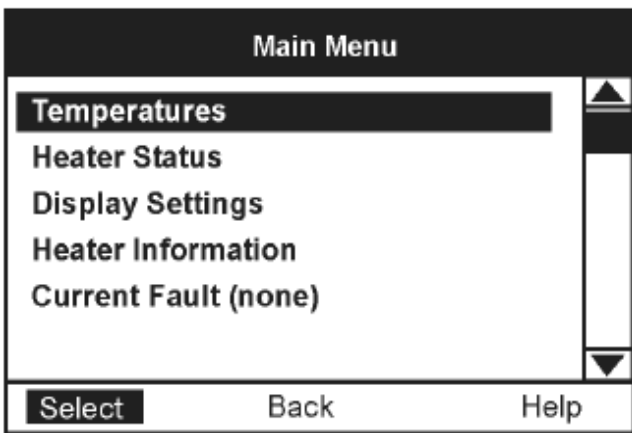
DISPLAY:



ACTION:

From the Main Menu, press **Select** to enter the "Temperatures" screen.

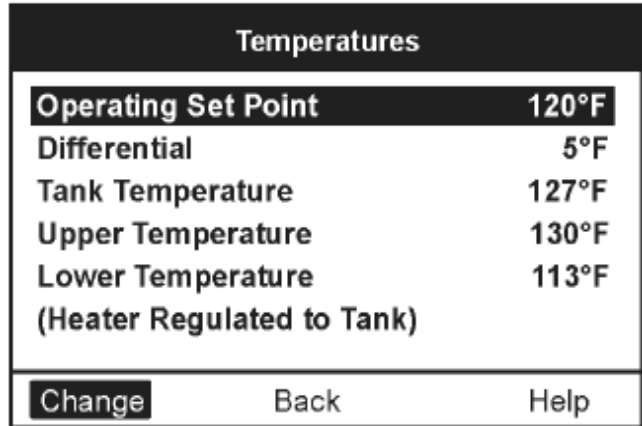
DISPLAY:



ACTION:

Press **Change** then use the **UP** and **DOWN** buttons to change the temperature Set Point.

DISPLAY:

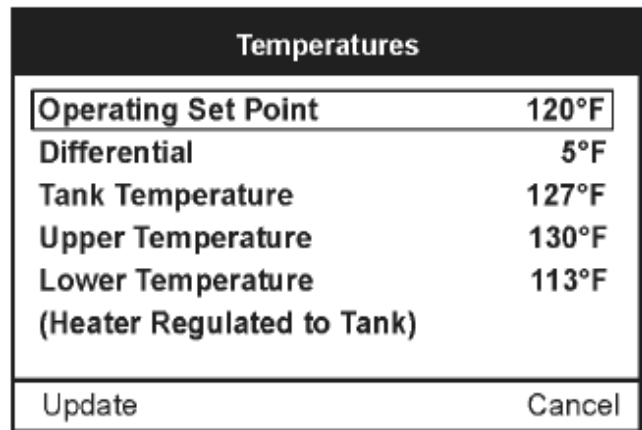


Note: This procedure can also be used to change the *Differential*. The tank Upper and Lower Temperatures are not user changeable. They are determined by the temperature probes on the heater.

ACTION:

Press **Update** to accept the change or **Cancel** to reset it.

DISPLAY:



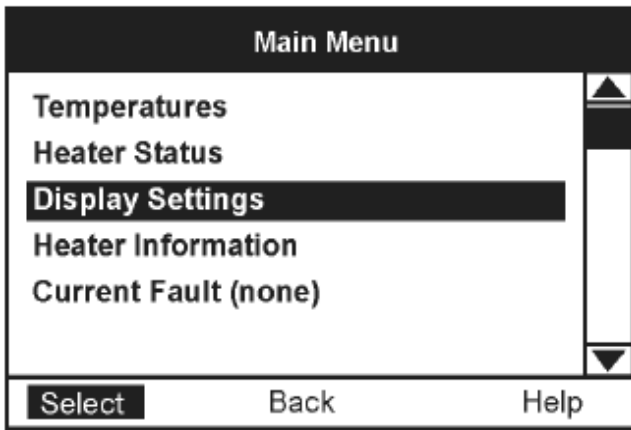
CHANGING THE DISPLAY UNITS

The desktop menu has the option of selecting between degrees Fahrenheit and degrees Celsius for temperature displays. This can be found in the "Display Settings" menu. Also in this menu, you may adjust how the back-light operates and the contrast of the LCD screen.

ACTION:

From the Main Menu, press the **DOWN** button to highlight "Display Settings" then press **Select**.

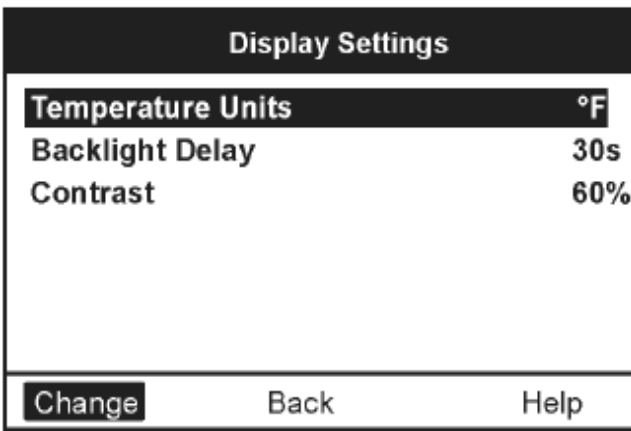
DISPLAY:



ACTION:

Use the **UP** and **DOWN** buttons to highlight the desired setting. Then press **Change**. Again, use the **UP** and **DOWN** buttons to scroll through the options for that setting.

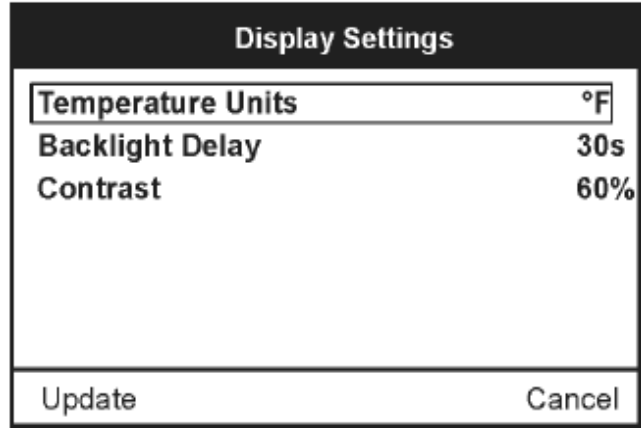
DISPLAY:



ACTION:

Press **Update** to accept the change or **Cancel** to reject it.

DISPLAY:



FAULT AND WARNING CONDITIONS – ADVANCED DIAGNOSTIC INFORMATION

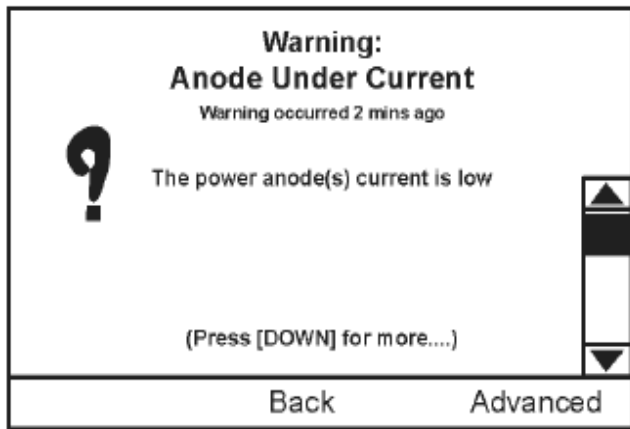
The water heater control system has the ability to monitor almost all aspects of the water heater's operation. In the case that there is an undesirable or unsafe condition that occurs, the control system will detect this condition and determine the appropriate action. The water heater control will display the information on the desktop in plain text that accurately describes the condition and diagnostics information that can be used to correct the issue.

There are two types of conditions that can occur during operation. These are **Warnings and Faults**:

Warnings: This is a non-safety related condition that the control has detected that may cause the water heater to operate in a less than optimal condition, but does not pose a safety concern.

NOTE: When these conditions occur, continued heating cycles will continue and the heater will attempt to regulate the water in the tank to the **Operating Set Point**.

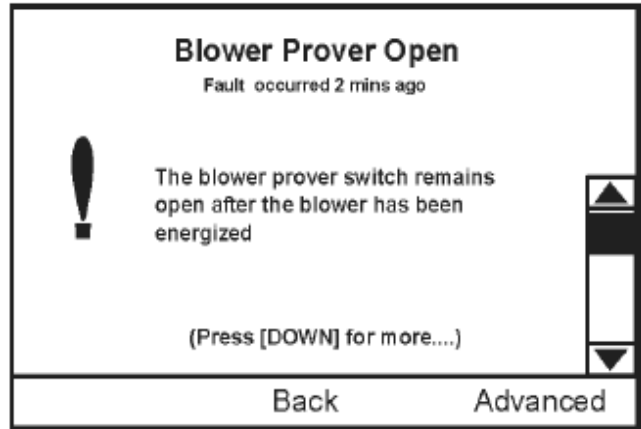
Example of a Warning:



Faults: This is a safety related condition that has been detected by the control system.

NOTE: When these conditions occur, the water heater **WILL NOT CONTINUE** any further heating cycles and the water will no longer be heated until the condition is corrected and, in most cases, power has been cycled.

Example of a Fault:



Advanced Diagnostic Information

When a fault or warning has been declared, advanced information can be found by pressing the Advanced button, there more detailed information can be found regarding diagnosing and resolving the problem.

WARNING: Usage of the Advanced information requires ability equivalent to that of a licensed tradesmen in the field involved.

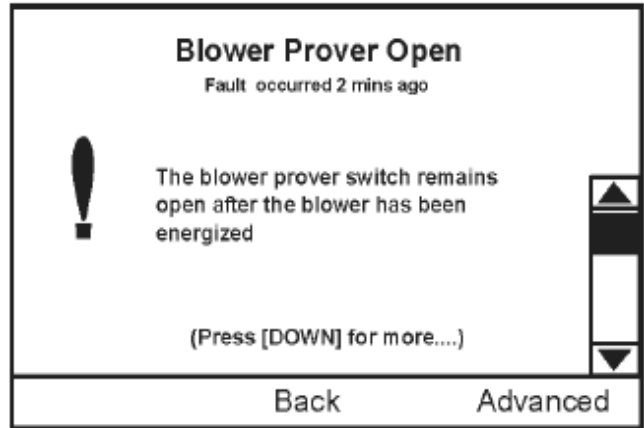
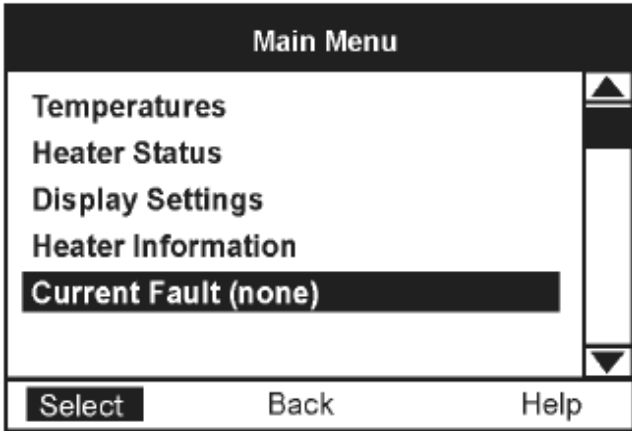
CURRENT FAULT OR WARNING

When a fault or warning condition has been declared by the control system it will automatically be displayed on the UIM display and the back light will blink. You can choose to leave the current fault or warning message by pressing the **Back** key. You can return to the current fault or warning message through the control system menu.

ACTION:

Press the **DOWN** button until the "Current Fault" sub menu is highlighted then press the **SELECT** button.

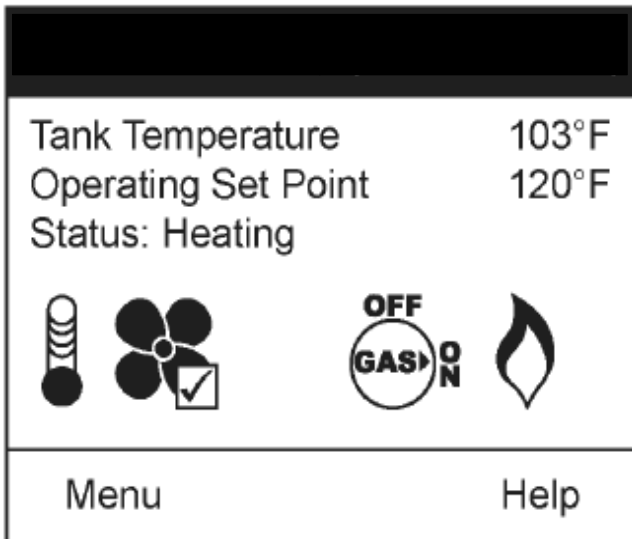
DISPLAY:



ACTION:

To access the current fault or warning message, press **MENU** from the default "Desktop" screen.

DISPLAY:



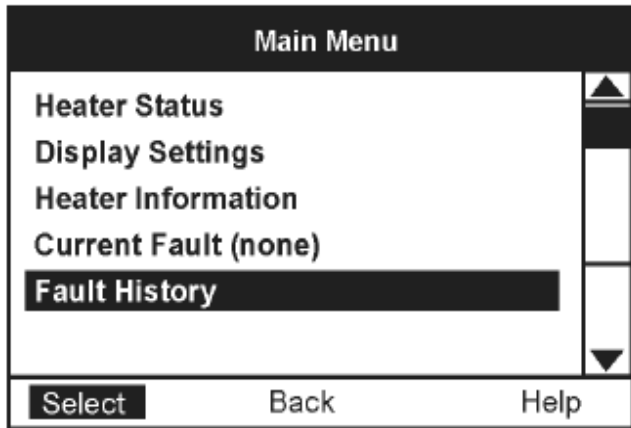
VIEWING THE FAULT HISTORY – WATER HEATER INFORMATION

The control system for this water heater will store a history of **ten** of the last **Fault and Warning** conditions that occurred. This is stored in the Fault History. The information about the fault or warning will include diagnostic information as well as an estimate of how long ago the fault occurred.

ACTION:

Press the **SELECT** button for more information.

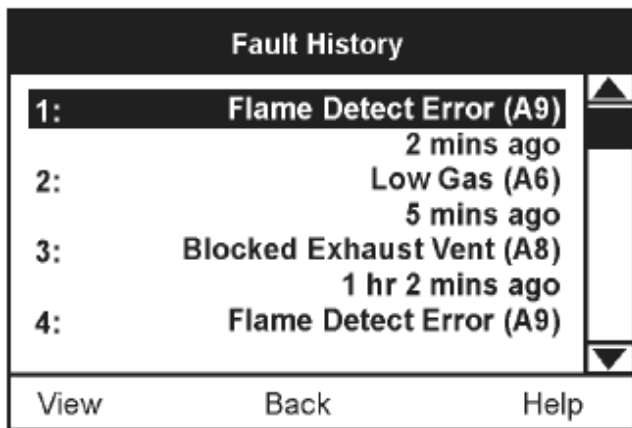
DISPLAY:



ACTION:

Press the **DOWN** key to scroll through the fault history. If you select a specific fault or warning, you may press the **VIEW** button to view details regarding this fault.

DISPLAY:



Viewing Information About the Water Heater

The control system for this water heater monitors many different aspects of operation to ensure safe and optimal performance. Much of this information can be viewed using two control system menus; the "**Heater Status**" menu and the "**Heater Information**" menu.

SEQUENCE OF OPERATION - TEXT

TYPICAL SEQUENCE

1. When the control is powered it should display “waiting for connection” and “ the UIM and CCB software revision numbers. The manufacturer and unit model will be next. The next display will include water temperature, temperature setting and control system status.

2. The control system performs selected system diagnostic checks. This includes confirming the proper state of all pressure switches, the ECO limit device and powered anode rods.

3. If the control system determines that the actual water temperature inside the tank is below the programmed temperature set-point minus the differential, a call for heat is activated.

4. If all checks are successfully passed, the combustion blower is energized for the pre-purge cycle. The blower prover switch contacts must close during this period.

5. When the pre-purge cycle is complete, power is applied to the igniter for the igniter warm-up period. The igniter must draw a minimum of 2.7 AC amps during this period.

6. At the conclusion of the igniter warm-up period, the gas valve will open, allowing gas to enter the burner.

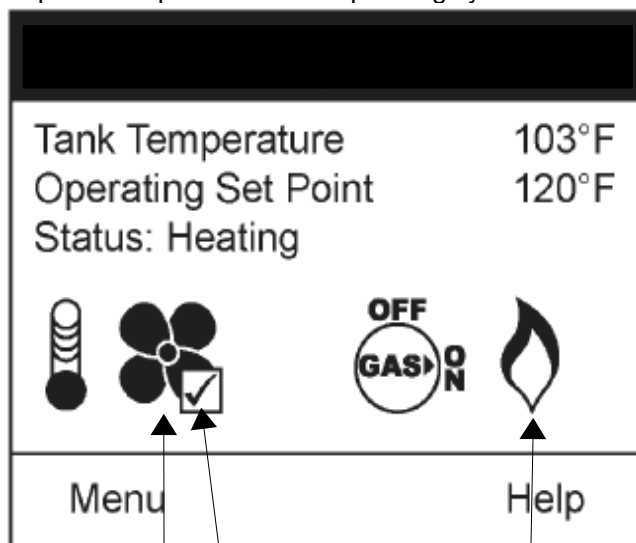
7. The igniter will remain on for a short predetermined time period, then will be turned off.

8. The control will monitor the flame sensor to verify a minimum of 0.7 DC micro amps. If a flame is not verified within predetermined time period, the gas valve will immediately be closed, and the blower will continue to run for approximately 30 seconds inter-purge. The control will try for ignition two more times before lockout.

9. If flame is verified, the control will enter the heating mode where it will continue heating until the set point temperature plus differential is reached. At this point, the gas valve is closed and the control enters the post-purge cycle.

10. The combustion blower will run for the duration of the post purge cycle to purge the system of all combustion gases. When the post purge cycle is complete, the blower is de-energized and will coast to a stop.

11. The control will now enter the standby operating state (mode) while continuing to monitor tank water temperature and other system devices. If the temperature drops below the set-point value minus differential, the control will automatically return to step 2 and repeat the entire operating cycle.

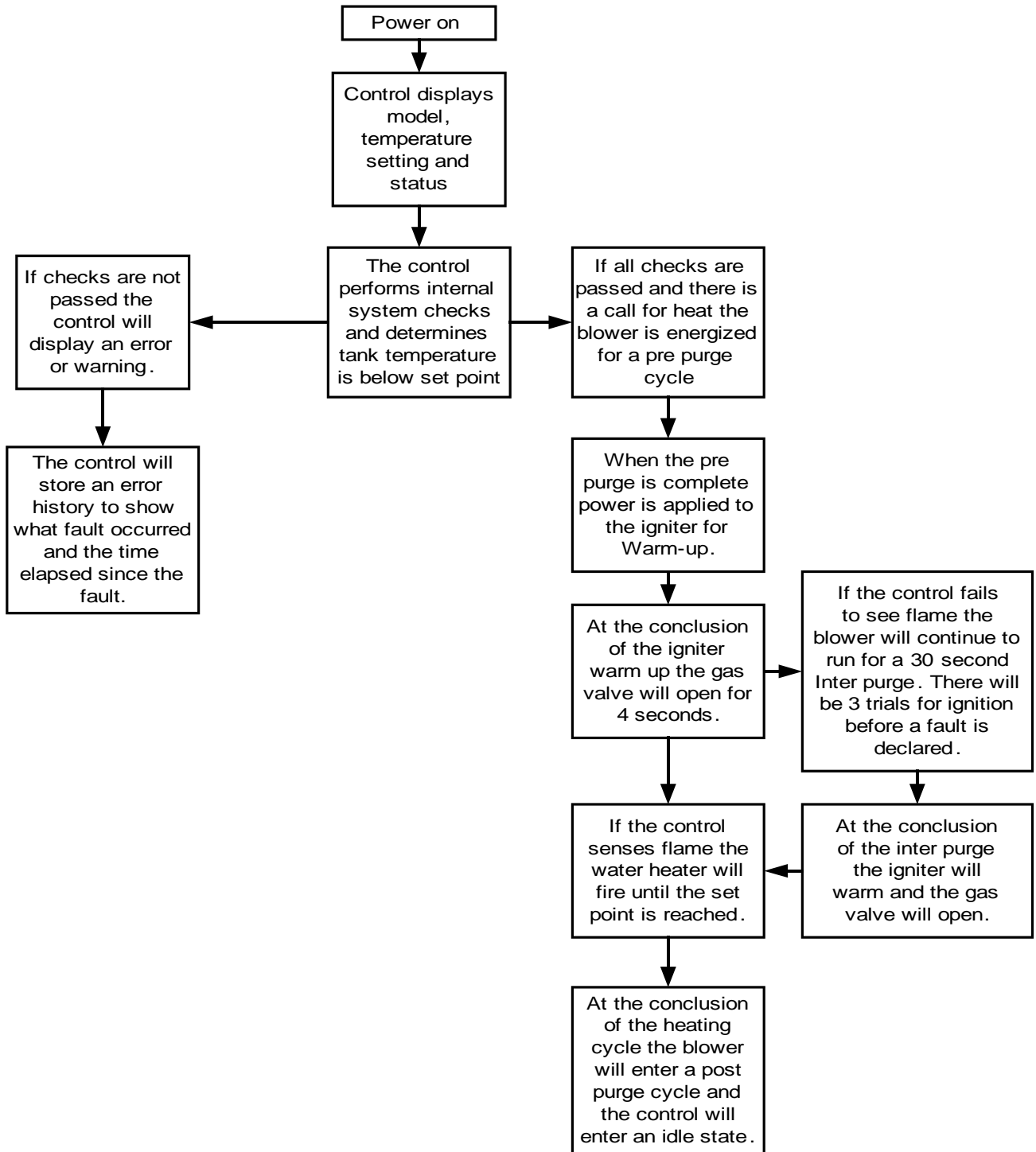


Blower icon indicates power to the blower

Check mark in the box indicates the blower proving switch contacts are made

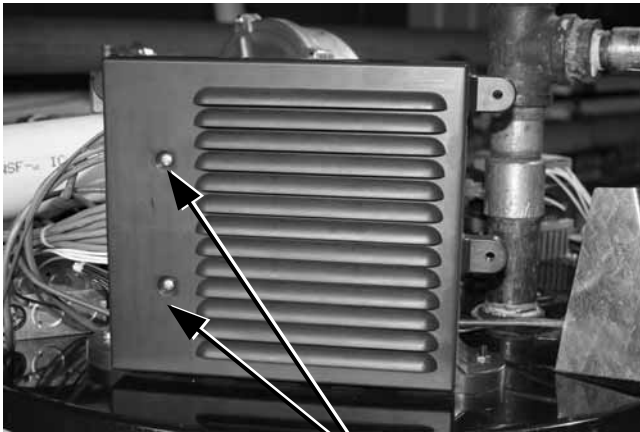
Flame icon indicates burner is ignited and that flame has been sensed.

SEQUENCE OF OPERATION – FLOW CHART



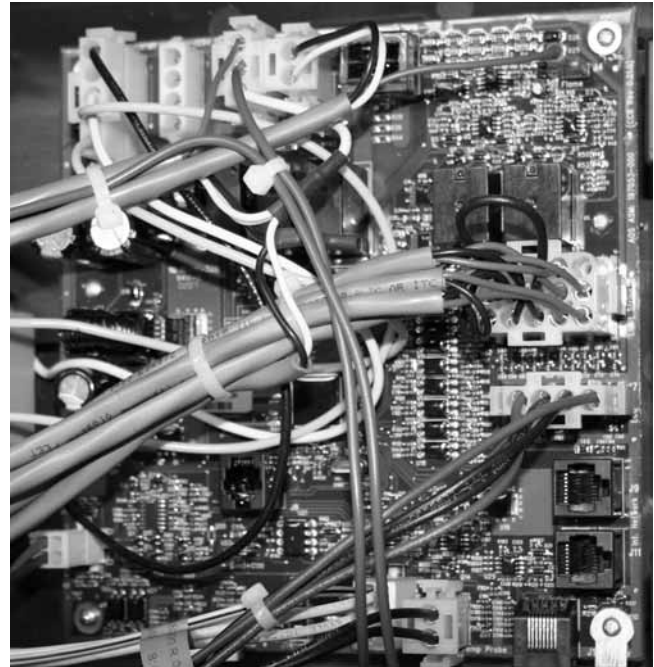
CONTROLS – CENTRAL CONTROL BOARD – CCB

The Central Control Board or CCB is contained in the housing shown below. Access to the board and the wiring harness plugs can be accomplished by removing two Phillips screws holding the cover.



Remove these screws to release cover

This view shows the cover removed from the CCB.

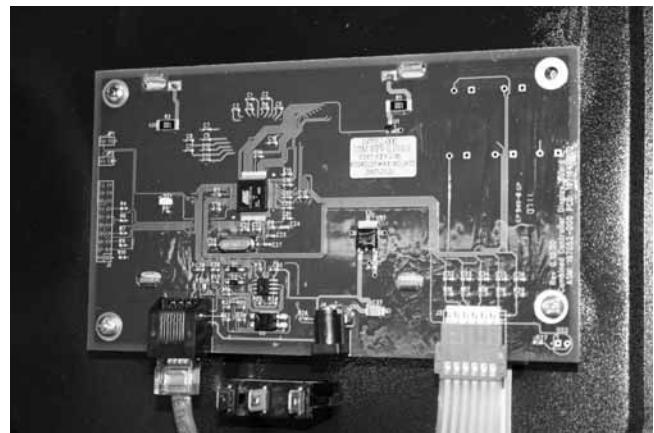


The CCB is controlled by the settings given through the desk top menu (UIM). The CCB also monitors all pressure switches, the hot surface igniter, tank temperatures, the gas valve, the anode rods, and the flame sensor.

The CCB directly controls blower speed on the 199 and 250 models.

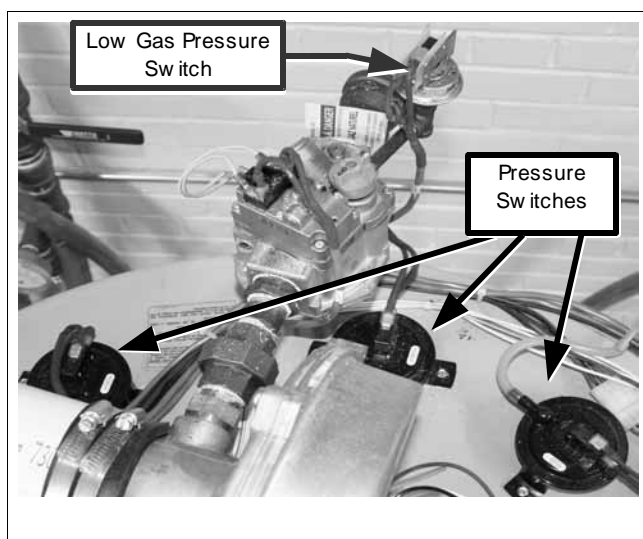
Note: Improper operation may be the result of a loose connection. Please check all wiring connections and the power supply to the water heater.

This is the back of the UIM.



CONTROLS – PRESSURE SWITCHES

All models are provided with four pressure switches. These switches are essential to the safe and proper operation of the unit. The switches are wired to the central control board (CCB) individually and each is monitored individually. The (CCB) is set up to shut the unit down whenever there is a failure of any of the switches and **declare a fault** for each individual switch. It is important to understand the purpose of each switch.



BLOWER PROVER SWITCH

The Blower Prover Switch is used to verify the combustion blower is operating. This switch has **normally open contacts that close on a pressure rise**. This switch is connected to the burner tap by a piece of Tygon (soft plastic) tubing. This tubing must be connected in order for the switch to close the electrical contacts. The control system requires that the electrical contacts on this switch be open before it will energize the blower. After the blower has been energized the control system requires that the contacts close. The control system will lock out and display a fault message on the UIM if either requirement is not met.

BLOCKED EXHAUST SWITCH

The Blocked Exhaust Switch is used to verify the water heater's vent (exhaust) piping is not restricted. This switch has **normally closed contacts that open on a pressure rise**. This switch is connected to the exhaust elbow with sections of aluminum and Tygon (soft plastic) tubing. The control system requires that the electrical contacts on this switch be closed at all times. The control system will lock out and display a fault message on the UIM if this requirement is not met. If the "Blocked Exhaust" fault message is displayed on the UIM ensure the condensate hose connected to the exhaust elbow is draining properly. Check for obstructions in the exhaust vent piping. Ensure the equivalent feet of vent pipe for the specific model has not been exceeded. Check the vent length tables on page 9

BLOCKED INTAKE AIR SWITCH

The Blocked Intake Air Switch is used to verify the water heater's supply of combustion air (intake) is not restricted. This switch has **normally closed contacts that open on a pressure fall**. This switch is connected to the pressure tap on the blower's intake air PVC flange with Tygon (soft plastic) tubing. The control system requires that the electrical contacts on this switch be closed at all times. The control system will lock out and display a fault message on the UIM if this requirement is not met. If the "Blocked Inlet" fault message is displayed on the UIM ensure the intake air piping on direct vent installations is not restricted. Ensure the screen on the intake air connection to the water heater was removed on direct vent installations. Ensure the screen on the intake air connection to the water heater is free of debris on conventional vent installations. Ensure the equivalent feet of intake air pipe for the specific model has not been exceeded. Check the vent length tables on page 9

LOW GAS PRESSURE SWITCH

The Low Gas Pressure Switch is used to verify the supply gas pressure is at or above minimum requirements. This switch has **normally open contacts that close on a pressure rise**. The control system requires that the electrical contacts on this switch be closed at all times. The control system will lock out and display a fault message on the UIM if this requirement is not met.

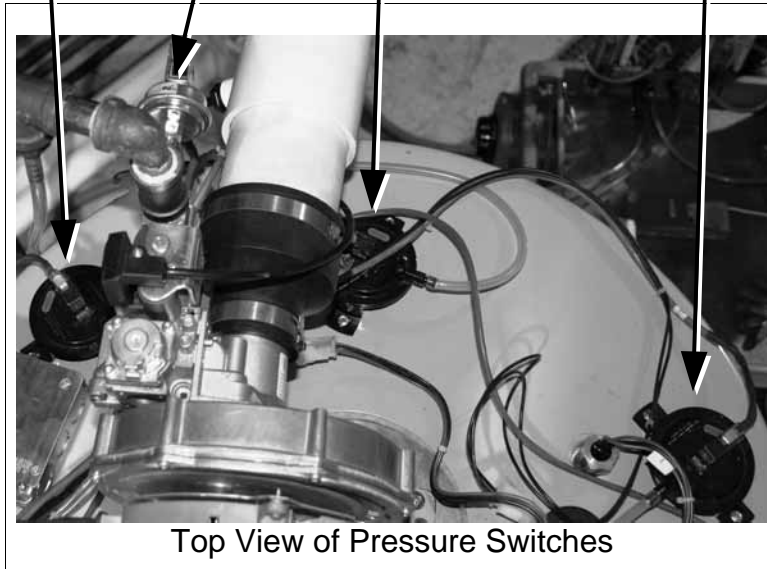
CONTROLS – PRESSURE SWITCHES (cont)

BLOCKED INTAKE AIR PRESSURE SWITCH	
MODEL	PRESSURE
Models 120 - 199	
Natural	-0.65" WC
LP	-0.85" WC
Model 250	
Natural	-0.85" WC
LP	-0.85" WC
Normally Closed / Opens on a Fall in Pressure	
Tolerance +/- .05" WC	

LOW GAS PRESSURE SWITCH	
MODEL	PRESSURE
Natural	+4.0" WC
LP	+8.0" WC
Normally Open / Close on a Rise in Pressure	
Tolerance +/- .05" WC	

BLOCKED EXHAUST PRESSURE SWITCH	
MODEL	SWITCH
120N	+1.2" WC
150N	+0.98" WC
199N	+1.06" WC
250N	+4.0" WC
120LP	+1.3" WC
150LP	+1.3" WC
199LP	+4.0" WC
250LP	+2.0" WC
Normally Closed / Open on a Rise in Pressure	
Tolerance +/- .05" WC	

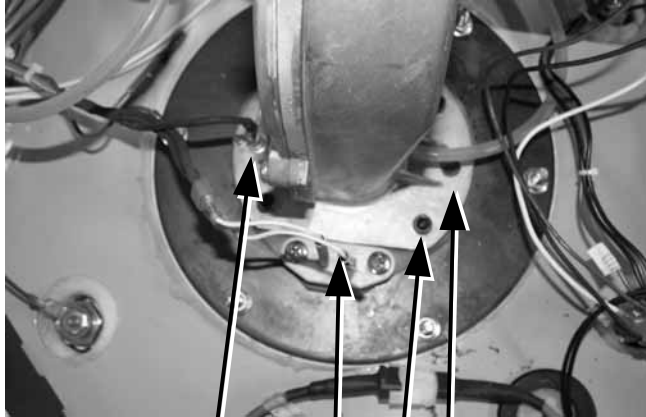
BLOWER PROVER PRESSURE SWITCH	
MODEL	PRESSURE
All	+0.75" WC
Normally Open / Close on a Rise in Pressure	
Tolerance +/- .05" WC	



Top View of Pressure Switches

CONTROLS – IGNITER, FLAME SENSOR, SIGHT GLASS, POWERED ANODES

The connections for the hot surface igniter and the flame sense rod are shown below. Also shown is the burner sight glass. These features are typical for all models.

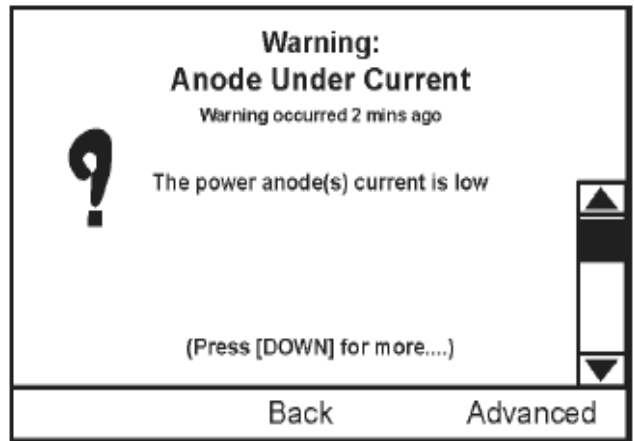


- Flame Sensor
- Hot Surface Igniter
- Burner Mounting Bolts
- Burner Sight Glass

The new High Efficiency commercial water heater is equipped with powered anodes. These anodes never need replacement. The CCB monitors the current through the anodes and will declare a fault if there is a disconnected wire or if there is no water in the tank.



Powered anode connection



MINIMUM IGNITER / FLAME SENSOR CURRENT - CONTROL TIMING

HOT SURFACE IGNITER

This water is equipped with an electric hot surface igniter. The igniter material is silicone carbide and should not be handled with bare hands because of possible damage to the igniter.

The normal ohm reading at 77°F is listed between 40 and 70 ohms. The minimum igniter current monitored by the CCB is 2.7 amps. Once this threshold is met a check mark will appear by the igniter icon in the UIM (display).



CONTROL TIMING

Pre-purge	25 seconds
Igniter Warm-up	17 seconds
Trial for ignition Gas Control Open	5 seconds
Inter/Post Purge	30 seconds

FLAME SENSOR

This water heater is equipped with an electronic flame sensor. The flame sensor senses flame by passing a small electric current through the burner flame. This type of flame sensing is also known as flame rectification. The CCB is looking for a minimum current of .7 micro amperes for the water heater to operate. Once this current is established the UIM will display a flame icon.



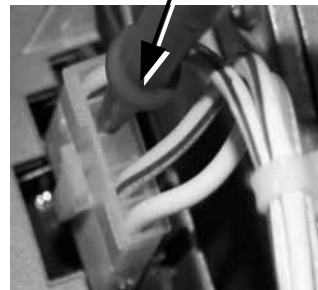
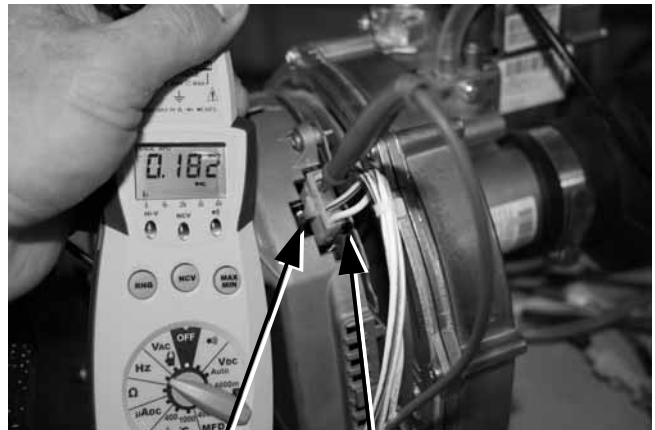
BLOWER SPEED CONTROL 199 AND 250 KBtu/hr MODELS

The input of the 199 and 250 KBtu/hr models is determined by blower speed. The input of the water heater may be determined by clocking the meter as shown on page 5 or by making sure the blower is receiving the proper Hz signal. The blower rpm is controlled by the Central Control Board (CCB). The signal to the blower may be measured by attaching a MULTIMETER that has a Hertz (Hz) setting as shown in the illustration to the right. If the Hz signal is within +/-

to a much higher rate.

Meter black lead is connected to ground (not shown) and the red lead is connected to an open terminal on blower speed control connection.

Model	Hz	Hz
199 N	133	87
250 N	133	87
199 LP	200	156
250 LP	266	96

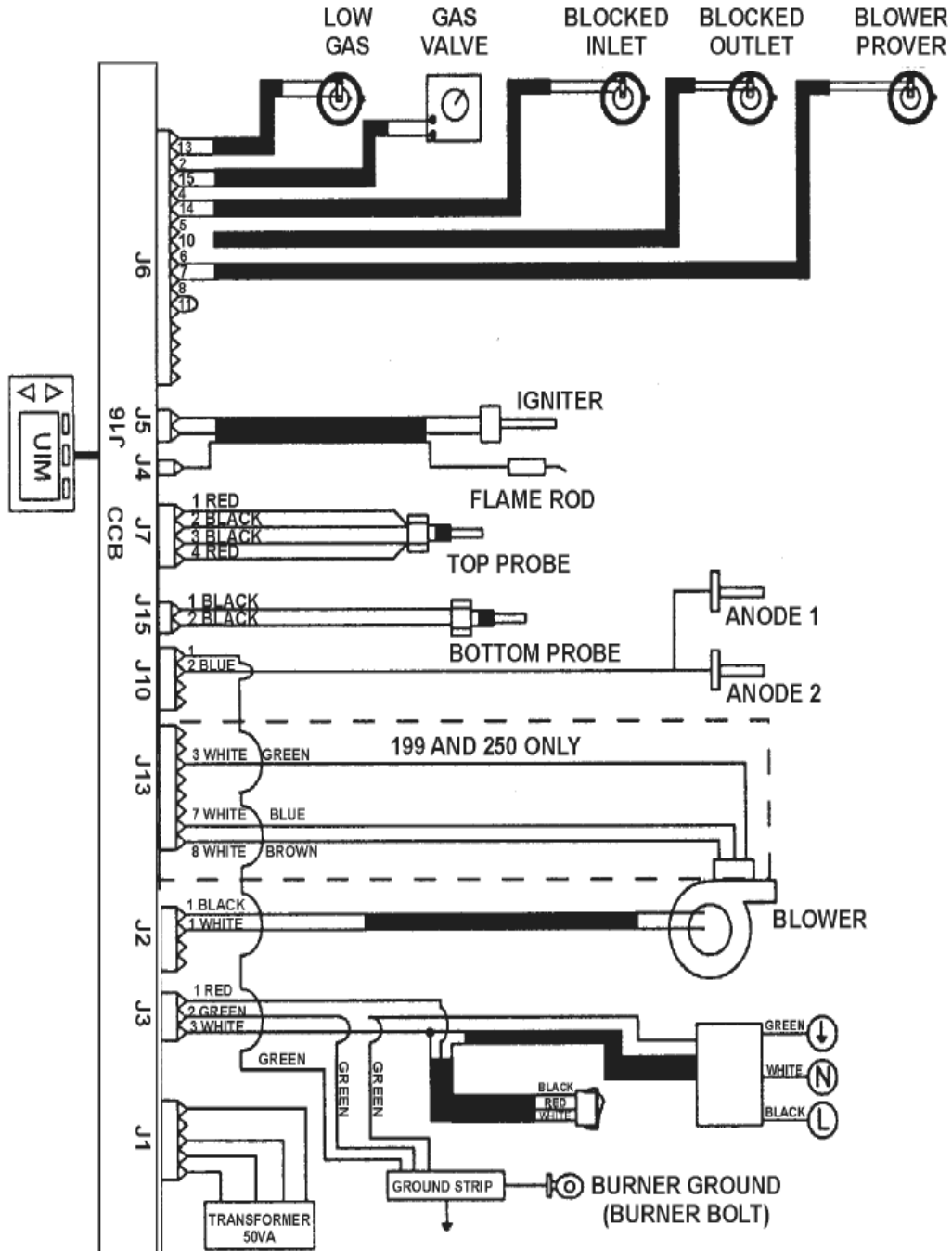


Meter red probe connected to open terminal on plug

Note: Removing the plug shown in the illustration will cause the blower to accelerate and the input of the water heater to increase

High-Efficiency Commercial Gas Series - Service Manual

WIRING DIAGRAM





PO Box 1597, 500 Princeton Road
Johnson City, TN 37605
www.americanwaterheater.com